Transportation Synthesis Report

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Crash Location Systems

Prepared for
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Transportation Synthesis Reports (TSRs) are brief summaries of currently available information on topics of interest to WisDOT technical staff in highway development, construction and operations. Online and print sources include NCHRP and other TRB programs, AASHTO, the research and practices of other state DOTs, and related academic and industry research.

REQUEST FOR REPORT

In 2001, approximately 3 million people were injured and 42,000 killed in the estimated 6.3 million police-reported motor vehicle traffic crashes in the U.S.[1] From 1996 through 2001, Wisconsin roadways sustained an average of 749 fatalities and 62,532 persons injured per year.[2]

Many motorists die and far more suffer severe and lasting injuries because emergency responders do not know when an auto crash or medical incident has occurred. Precious minutes and lives are lost because emergency responders cannot automatically locate a wireless 911 caller or dispatch appropriate emergency care. According to the National Highway and Traffic Safety Administration, the first 60 minutes of care after a multiple trauma injury are crucial. Trauma experts often refer to this crucial life or death time period as the "Golden Hour." Experts in the field have determined that during the Golden Hour the likelihood of death increases 1 percent for every minute lost before emergency care arrives.[3]

The RD&T Program was asked to identify the costs, advantages and disadvantages of various crash location systems being used in the U.S., Canada and overseas.

([1]NHTSA Traffic Safety Facts 2001 Overview
http://www-nrd.nhtsa.dot.gov/pdf/nrd-30/NCSA/TSF2001/2001overview.pdf
[2]WisDOT final year 2001 crash statistics
http://www.dot.wisconsin.gov/drivers/drivers/traffic/crash/final.htm
[3]American Trauma Society- Health News & Updates
http://208.58.30.127/Health%20Care/page14.html

SUMMARY

Our search for information took us to the Web sites of domestic and foreign transportation agencies, automakers and Intelligent Transportation System groups, as well as the ComCARE Alliance. The latter is a nonprofit coalition of more than 50 organizations representing physicians and nurses, the wireless industry, auto safety groups, telematics[4] service providers (TSPs), and public safety groups working together to enhance the nation's emergency response systems, and to educate the public, business and government about telematics systems and other safety issues.

([4]Telematics is a broad term that covers wireless voice and data systems in vehicles, usually with location devices such as GPS equipment. Current telematics systems often use a service provider for safety and convenience services. Besides emergency services, other applications include remote engine diagnostics, navigation and e-commerce such as buying tickets and making reservations.)

Our search indicates that telecommunications, automotive and location technologies are leading the way in the development of crash location systems. They are converging to develop "Automatic Crash Notification Systems" (ACNs) that can automatically notify emergency responders when a vehicle is in a serious collision. ACNs instantly alert a TSP when a passenger presses the car's "Mayday button" or the air bag deploys.

In the recent past, a series of field trials around emergency service systems have provided a good insight into the requirements for Mayday call support for motorists. In the U.S., the 1993 National Conference for Rural IVHS (Intelligent Vehicle Highway Systems) in Colorado brought the need for Mayday systems to the attention of the ITS world and in many ways triggered a series of operational tests. The Colorado Mayday project (a link is provided further on in this report) was led by Colorado DOT and was one of the first in the series.

More than a dozen commercial in-vehicle Mayday devices are available to consumers today, and commercial Mayday providers continue to upgrade their systems and expand their deployed base The devices typically combine wireless telephone technology, GPS and in-vehicle sensors to provide such services as anti-theft, remote door unlocking, roadside assistance and accident notification.[5] Automakers, especially General Motors, Ford and Mercedes-Benz, are betting on the technology's future. All three not only have emergency systems but also plan to have Internet connections in many of their cars.[6] (See **Automakers**, below.)

([5]Accident Reconstruction Network news- November 1999
http://www.accidentreconstruction.com/news/nov99/110999c.html
[6]Wireless Week: "Wireless in the Driver's Seat"- Brad Smith- Feb. 21, 2000
http://www.wirelessweek.com/index.asp?layout=story&articleid=CA3150)

The Multi-Jurisdictional Mayday project (MJM) formed in 1995 to link Mayday operational tests occurring in the states of Washington, Colorado, Minnesota and New York. Though MJM's active mission was completed in 1998, the resulting documents and lessons learned continue to benefit organizations and regions considering Mayday systems. (See **The Multi-Jurisdictional Mayday Project**, below.)

At the national level, the USDOT-led National Mayday Readiness Initiative (NMRI) is working to facilitate the integration of ACN systems with the public infrastructure and 911. Standards-setting bodies are developing, and building consensus for, standard communication protocols. The ultimate goal of these efforts is the widespread deployment of ACN equipment and capabilities, and integration of this technology with the national and local public safety infrastructure. (See **The National Mayday Readiness Initiative**, below.)

States active in development and testing of crash notification systems include Wisconsin neighbors, Minnesota and Iowa, as well as Harris County in Texas. Current efforts are supported with federal and state funding aimed at proof of concept, data gathering, public education and continued technology development. (See **What other states are doing**, below.)

In Europe, the CGALIES group, set up by the EC, is working out the location requirements and feasible technical solutions of Mayday deployment. These developments are expected to lead to the introduction of a solution where Mayday calls will include a digital latitude-longitude geographical reference. This reference information can arrive directly at a public service answering point (PSAP) or indirectly via a service provider. Ideally it should be possible to forward the same information to others in the emergency response help chain.[7] Germany currently operates a sophisticated, comprehensive ACN system; Canada is pursuing development of its own automated system. (See **What other countries are doing**, below.)

[7]Rosetta Work Areas- Emergency Service Systems
http://www.trg.soton.ac.uk/rosetta/workareas/2a_ess/ess_pr1_intro.htm)

AUTOMAKERS

The "OnStar system" offered by General Motors, Honda, Acura and Saab provides subscribers a variety of services including Push-button for Emergency Services and Air Bag Deployment Notification. http://www.onstar.com/.

The "Audi Telematics by OnStar" system will offer customers a variety of safety, security and convenience features, including automatic notification of air bag deployment.
http://www.audiusa.com/about_pressrelease_detail/0,,articleId-1000_countrycode-1_subUsageId-90_,00.html
(Note: This link may need to be copied and pasted into your browser since Adobe PDF files do not interpret commas in URL addresses.)

Ford Motor Co. says its crash notification system can get information to 911 operators in less than 60 seconds after an accident. The system can tell dispatchers details such as whether the vehicle flipped, where the occupants are sitting, whether air bags deployed and if seat belts were used, in under a minute. Ford began installing the technology in June 2002 in 500 police sedans in 23 cities near Houston as part of a two-year pilot program. Current Ford ACN links can be found at http://www.business2.com/webguide/0,1660,16550,00.html (Note: This link may need to be copied and pasted into your browser since Adobe PDF files do not interpret commas in URL addresses.)

The Mercedes-Benz "TeleAid" system provides an SOS button on the rear-view mirror. Pushing the SOS button immediately establishes voice contact with Protection One, a provider contracted by Mercedes-Benz. The Protection One representative can dispatch local police or other emergency services. Pressing this button also transmits to Protection One crucial information about the customer, including the precise location of the vehicle (through the GPS tracking) and the model of the car and its color (to help emergency services visually locate the car quickly). Protection One can also dispatch local police, fire or emergency services if voice contact is not established (e.g., the customer is unable to respond). If a collision deploys any air bag, the system automatically establishes contact with Protection One, relaying all pertinent information. The onboard transmitter is crash-secure, and has access to redundant antennae. http://www.autoworld.com/news/Mercedes/TeleAid.htm

How much will telematics cost the consumer? Prices would vary from one manufacturer to another. However, OnStar pricing for SAAB may provide a rough guideline. OnStar's manufacturer-suggested sale price in Saab vehicles is $895, which includes three months of the Premium Service Plan. After the initial three months, a basic Safety And Security Plan is $16.95 per month and includes airbag deployment notification, vehicle theft tracking and emergency assistance. The comprehensive Premium Service Plan, which includes all of the basic services in the safety and security plan plus route guidance and all concierge services, is $34.95 per month and provides unlimited calls to the OnStar center. Rule-of-thumb averages for cost are in the $500-$1000 range for the hardware option and $199 to $399 per year for the service. Many dealers would discount the first year service costs in the base price of the car itself.[8]

([8]MobileInfo Intro to Telematics
http://www.mobileinfo.com/Telematics/index.htm)

Telematics vendors and carriers are also major players. ATX of San Antonio provides services for Mercedes-Benz, Ford, Lincoln-Mercury, Jaguar, Infiniti and other companies. Its customer base grew from 8,000 to 75,000 in 1999 and currently is adding 10,000 new users monthly. The Motorola Telematics Group, which designed the Ford RESCU system (http://www.worldbusinessreview.com/underwriters/ford/) in 1996, has positioned itself as a key element in many solutions. Motorola has invested in two development companies—BCI Navigation of France and Liikkuva Systems International Inc. of Sacramento—to design services for vehicle use.[9]

([9]Wireless Week: "Wireless in the Driver's Seat"- Brad Smith [02-21-00]
http://www.wirelessweek.com/index.asp?layout=story&articleid=CA3150)

THE MULTI-JURISDICTIONAL MAYDAY PROJECT

A Multi-Jurisdictional Mayday (MJM) group was active between 1995 and 1999 as a forum for critical analysis and information exchange on the risks, barriers and opportunities associated with Mayday deployment, to represent the needs and desires of public and private sector response agencies in the Mayday arena, with particular emphasis on standards and systems' functional requirements. MJM was born out of a common desire on the part of a number of public agencies to increase personal safety and security of travelers through deployment of Mayday systems. The four founding projects included:

- Colorado Mayday - a test on in-vehicle location and voice communication technologies

- Washington PuSHMe - a test of both manually activated two-way data only, and data and voice emergency notification units
  http://www.benefitcost.its.dot.gov/its/benecost.nsf/ID/1DFB5512B40047A3852569610051E275?OpenDocument&Query=State

- New York Mayday - a test of an automated collision notification system.
  http://www-nrd.nhtsa.dot.gov/departments/nrd-01/summaries/ITS_13.html

- Minnesota Mayday Plus - developed to test and establish an emergency detection and response infrastructure, and to prepare for scalable deployment of a self-sustaining automated crash location and collision severity notification system.

MJM successfully educated public agencies interested in the Mayday concept, and allowed vendors of Mayday products to hear feedback from such agencies. MJM also allowed separate projects to benefit from collaboration with other emergency response systems. Though the program has completed its active mission, the resulting documents and lessons learned continue to benefit organizations and regions considering Mayday systems.

THE NATIONAL MAYDAY READINESS INITIATIVE

ComCare background report (2001)
http://www.comcare.org/research/topics/nmri.html
Like the safety benefits provided by seat belts and air bags, telematics Mayday systems represent the next generation of in-vehicle safety technology. However, the technologies present a challenge for public emergency response agencies. Private sector call centers, which initially receive the calls and data from Mayday devices, must be able to communicate quickly and efficiently with the nation's 6,000-plus 911 PSAPs and other public safety agencies.

NMRI is a public-private partnership of more than 20 national organizations that have been meeting to develop and address the multiple, overlapping issues that arise in the relationships among private Mayday TSPs such as OnStar, ATX Technologies and AAA Response, and the nation's public emergency response agencies. The initiative is co-sponsored by USDOT and ComCARE, and supported by a grant from General Motors/OnStar.

After six months of committee meetings, the NMRI participants publicly released their recommendations in October 2000. The key recommendations included:

- Updating training standards for Mayday call takers and PSAPs and outlining a process of accreditation by the public safety community for telematics service providers;
- Establishing a National Emergency Directory of all public safety agencies in America;
- A call to upgrade emergency response technologies and developing procedures for improved data sharing among public safety agencies;
- Development of uniformly acceptable business practices by telematics companies;
- Continuing focus on ACN and establishing a sophisticated ACN Committee.

From the recommendations
http://www.comcare.org/projects/word/nmri_summary_final.doc
The nature of Mayday and ACN is that a wide variety of parties are involved in developing, sharing and using crash and related data. A technical standards coordination effort should be initiated so that all the appropriate stakeholders are involved in relevant standards that affect their responsibility. This should be led by an organization such as ITS America or USDOT and should include contacting the standards leaders in the relevant bodies (i.e. SAE, ITE, IEEE, TIA, NENA, APCO, ASTM) to ensure coordination and inclusion of groups that typically would not participate in technical standard setting, such as leaders in emergency medicine.

(If you would like to become involved in the next steps of the Initiative, contact Patrick Halley of ComCARE at phalley@comcare.org or 202-429-0574.)

WHAT OTHER STATES ARE DOING

Minnesota

Mayday Field Operational Test
For information, contact: Brad Estochen, ITS Project Manager / Senior Engineer, Office of Traffic Engineering and ITS, Minnesota Department of Transportation
bradley.estochen@dot.state.mn.us
"Our current project," Brad said, "is the federally-funded 'MayDay Field Operational Test' (different from the MayDay Plus Project). This is a project involving OnStar (which is primarily responsible for nationwide proliferation of ACN systems), the Mayo Clinic, Minnesota State Patrol and yet to be determined vendors to perform the voice and data routing capabilities outlined in their proposals. OnStar, as you are probably aware, offers automatic crash notification when the airbag is deployed or an alarm is manually activated. The primary emphasis of this project is to develop a solution that can determine where this call should be routed. If one of our previous MayDay Plus vehicles equipped with the technology is involved in a crash somewhere in New York, the call would still be routed to a Southwest Minnesota public service answering point."

"A second goal of the test is to get information (data) from the vehicle so that decision makers can determine the appropriate action to take. For example, if the final resting position of the vehicle is on its roof a dispatcher would send out fire and ambulance because extrication may be required. The benefits from this should be obvious."

Brad said that a total of $2.8 million in federal and state funds have been allocated for the project ($1.1 million through a competitive federal grant process and $1.8 million in state funding). Project goals also include minimizing the startup cost of deploying the technology. Brad is part of a team preparing a report that will address participant costs associated with expanding the program. TSPs, for example, may be able to incorporate the deployment of the technology during routine upgrades of their system.

"TSPs, meanwhile, are building a record of reliable transmission of wireless Mayday signals," Brad said. "Consistent TSP coverage is being established from coast-to-coast. OnStar has emerged as a leader in the field and currently covers a majority of the U.S. Adverse weather has not had a measurable impact on signal consistency. However, there are isolated instances when crashes are so severe that they disable the Mayday hardware installed in vehicles. The problem is being addressed through technical research."

Texas

Background of the Greater Harris County 911 Network
http://www.urisa.org/Street%20Smart%20Conference/address02/papers/MBerryman.pdf
In June 2000, the Greater Harris County 911 Network, in partnership with Intrado (then SCC) Communications, Southwestern Bell, Veridian Engineering, Plant Equipment, Inc. and Combix Corp. conducted the nation's first end-to-end trial of ACN. The test included a GPS location of the test crash vehicle involved, and crash pulse data-information such as change in velocity, number of occupants, seat belts in use, and other data relayed to a PSAP and a trauma center. Startup cost was approximately $2 million, with funding provided by Greater Harris County. Wireless Mayday transmission proved to be "at least as reliable as a cell call, with good weather reliability and no measurable blockage by tall buildings," according to Stu Miller, Product Manager for Telematics at Intrado. "The only real glitches that surfaced concerned call-handling. The TSPs and 911 people weren't always sure how to channel calls."

Upon vehicle impact, the location and crash data was instantly transmitted to Intrado. Based on the longitude and latitude of the vehicle, this data was relayed to the Houston Fire Department (HFD). Intrado initiated a voice connection to the vehicle, and connected the call to the Southwestern Bell Selective Routing Tandem in Houston, where it was routed to the HFD PSAP. Integrated computer telephony equipment allowed voice communication, crash information, and the location of the crash on a digital map, to be viewed and recorded. The crash pulse data was also relayed to the receiving trauma center.

The project showed that it was possible for a vehicle equipped with telematic devices to relay data directly into a PSAP, and to a trauma center. This proof-of-concept led to the "Enhanced Automatic Crash Notification" project. This project delivers enhanced crash data and voice communication from the telematic-equipped automobile into the existing E911 system. This project started in the latter part of June 2002.

Iowa
Center for Transportation Research and Education
Development of GIS Accident Location and Analysis Systems (GIS-ALAS) Phase 1
http://www.ctre.iastate.edu/research/detail.cfm?projectID=241
This project proposes to address the development of a GIS-based tool to be integrated into the MARS software (http://showcase.netins.net/web/softshell/softshHi.html) with which local agencies, as well as the Motor Vehicles Division, can locate crashes. This tool would use smart maps to allow the user to view a map on a computer screen and select the appropriate crash location. The coordinates of this location would then be saved and linked to the other crash data collected. The tool would be available both in mobile applications (i.e. police vehicles) and in desktop use in an office setting. This would provide the required functionality for creating and providing crash reports, both to local agencies with the mobile application and to local agencies with only the desktop application, as well as to the Motor Vehicle Division.

WHAT OTHER COUNTRIES ARE DOING

Germany
Emergency Call Center
http://www.ertico.com/its_basi/succstor/ecccon.htm
The Emergency Call Center (ECC) gives immediate notice of accidents or problems and reduces the time elapsed between accident and action. The ECC system combines components of existing mobile phone network and route guidance systems with an emergency call center. The call system is activated automatically (by built-in crash sensors) or manually (by an occupant of the car). A transceiver transmits data from the car to the ECC service center via mobile phones. The information includes the precise location of the vehicle (determined with GPS or a similar technique) and the vehicle type. The call is received by the ECC service center and the data are analyzed and displayed on a digital map. At the same time, the incident is reported to the responsible public emergency service center (PESC) or police station. The call is then passed on with a voice link that enables direct contact between the vehicle and the PESC.

ECC service centers can be set up in any country with a mobile phone network, regardless of the standard used. The use of standard hard- and software makes it easy to use for operators. Service providers can link the system to their accounting and billing systems, via interfaces. The application software for ECC was developed by debis Systemhaus, in cooperation with international partners. This software has a modular architecture to enable adaptations and meet the future needs for high-performance, automatic emergency call systems. The modularity ensures that components can be selected and adapted in view of ever-changing conditions.

Canada
Development of a Canadian Architecture for Intelligent Transportation Systems
The Preliminary Description of ITS User Services for Canada
http://www.its-sti.gc.ca/en/downloads/canadian_architecture.htm

- Traffic Management Services:
  The Incident Management user service enhances existing capabilities to identify incidents, formulate response actions, and support initiation and ongoing coordination of those response actions. The single subservice of the Incident Management user service provides six major functions such as: (1) Scheduled Planned Incidents, (2) Identify Incidents, (3) Formulate Response Actions, (4) Support Coordinated Implementation of Response Actions, (5) Support Initialization of Response to Actions, and (6) Predict Hazardous Conditions.

- Emergency Management Services:
  The Emergency Notification and Personal Security user service provides the capability for the user to manually initiate a distress signal for incidents like mechanical breakdown or non-injury collisions. An automated system would help mitigate the consequences of a serious collision by automatically sending information regarding the location, nature and severity of the collision to an emergency services dispatcher and/or to hospital and emergency room personnel.